

Appl. No. : 09/995,816
Filed : November 27, 2001

LISTING OF THE PENDING CLAIMS

1. (Previously presented) An electroluminescent device comprising at least one of a hole-injecting layer and an electron-injecting layer, wherein the at least one of the hole-injecting layer and the electron-injecting layer comprises a polymeric compound and a movable ion, wherein the polymeric compound has at least one block of $[\text{O}-(\text{CH}_2)_x]_y$ units and at least one non-movable ionic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two, and wherein the movable ion and the at least one non-movable ionic moiety are counter ions.
2. (Previously presented) An electroluminescent device comprising:
 - a substrate;
 - a first electrode deposited on the substrate;
 - an emissive layer comprising an organic electroluminescent material;
 - a second electrode deposited over the electron-injecting layer;
 - at least one of a hole-injecting layer and an electron injecting layer, the hole-injecting layer being positioned between the emissive layer and the first electrode, the electron-injecting layer being positioned between the emissive layer and the second electrode; andwherein the hole-injecting layer, the electron-injecting layer, or both, comprises a polymeric compound and a movable ion, wherein the polymeric compound has at least one block of $[\text{O}-(\text{CH}_2)_x]_y$ units and at least one non-movable ionic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two, and wherein the movable ion and the at least one non-movable ionic moiety are counter ions.
3. (Currently amended) The electroluminescent device of Claim 2, wherein the substrate comprises a material selected from the group consisting of glass, quartz, and polyethylene terephthalate.
4. (Previously presented) The electroluminescent device of Claim 2, wherein the first electrode comprises a material selected from the group consisting of lead oxide, indium tin oxide, doped polyaniline, doped polypyrrole, doped polythiophene, and polyethylene dioxythiophene.
5. (Original) The electroluminescent device of Claim 2, wherein the emissive layer comprises a material selected from the group consisting of emissive conjugated polymer,

Appl. No. : 09/995,816
 Filed : November 27, 2001

emissive non-conjugated polymer, emissive monomeric or oligomeric material, poly(meta-methylacrylic acid), poly(styrene), and poly(9-vinylcarbazole).

6. (Original) The electroluminescent device of Claim 5, wherein the emissive conjugated polymer is selected from the group consisting of poly(*p*-phenylene vinylene), poly(thiophene), poly(*p*-phenylene), poly(fluorene), poly(arylenes), poly(arylene vinylene), polyquinoline, polypyrrole, polyaniline, polyacetylene, and derivatives thereof.

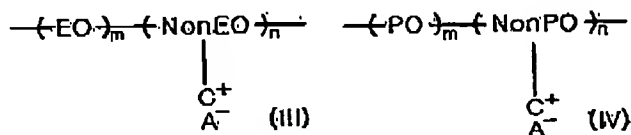
7. (Original) The electroluminescent device of Claim 5, wherein the emissive non-conjugated polymer is a polymer having non-conjugated main chains and side chains substituted with emissive functional groups.

8. (Original) The electroluminescent device of Claim 5, wherein the emissive monomeric or oligomeric material is selected from the group consisting of alumina quinone, rubrene, anthracene, perylene, coumarine 6, Nile red, aromatic diamine, *N,N'*-diphenyl-*N,N'*-bis-(3-methylphenyl)-1,1'-biphenyl-4,4'-diamine), (3-(4-biphenyl)-4-phenyl-5-(4-tert-butylphenyl)-1,2,4-triazole), (dicyanomethylene)-2-methyl-6-(*p*-dimethylaminostyryl)-4*H*-pyran), and derivatives thereof.

9. (Previously presented) The electroluminescent device of Claim 2, wherein the second electrode comprises a material selected from the group consisting of aluminum, magnesium, lithium, calcium, copper, silver, iron, platinum, indium, palladium, tungsten, zinc, gold, lead, and alloys thereof.

10. (Previously presented) The electroluminescent device of Claim 2, wherein the movable ion in the hole-injecting layer is an anion.

11. (Previously presented) The electroluminescent device of Claim 2, wherein the polymeric compound is represented by one or more formulas selected from the group consisting of the formula (III) and formula (IV),



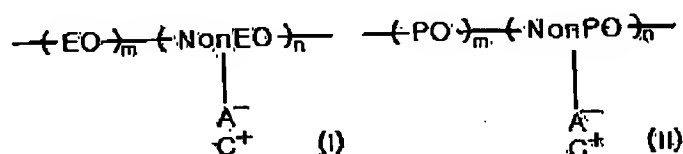
wherein EO represents ethylene oxide; NonEO represents non-ethylene oxide; PO represents propylene oxide; NonPO represents non-propylene oxide; A⁻ represents an

Appl. No. : 09/995,816
 Filed : November 27, 2001

anion; C^+ represents a cation; $m + n = 1$; and n represents a number more than 0 and less than 1.

12. (Previously presented) The electroluminescent device of Claim 2, wherein the movable ion in the electron-injecting layer is a cation.

13. (Previously presented) The electroluminescent device of Claim 12, wherein the polymeric compound is represented by one or more formulas selected from the group consisting of the formula (I) and the formula (II),



wherein EO represents ethylene oxide; NonEO represents non-ethylene oxide; PO represents propylene oxide; NonPO represents non-propylene oxide; A^- represents an anion; C^+ represents a cation; $m + n = 1$; and n is a number more than 0 less than 1.

14. (Previously presented) An electroluminescent device comprising:

a transparent substrate;

a semitransparent electrode deposited on the transparent substrate;

a hole-injecting layer positioned on the semitransparent electrode, the hole-injecting layer comprising a polymeric compound and a movable anion, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable cationic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two;

an emissive layer comprising an organic electroluminescent material, positioned on the hole-injecting layer;

an electron-injecting layer positioned on the emissive layer, the electron-injecting layer comprising a polymeric compound and a movable cation, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable anionic moiety, wherein x' is an integer equal to or greater than two, wherein y' is an integer equal to or greater than two; and

a metal electrode deposited on the electron-injecting layer.

Appl. No. : 09/995,816
Filed : November 27, 2001

15. (Previously presented) An electroluminescent device comprising:
- a transparent substrate;
 - a semitransparent electrode deposited on the transparent substrate;
 - an electron-injecting layer comprising positioned on the semitransparent electrode, the electron-injecting layer comprising a polymeric compound and a movable cation, the polymeric compound having at least one block of $[O-(CH_2)_{x'}]_{y'}$ units and at least one non-movable anionic moiety, wherein x' is an integer equal to or greater than two, wherein y' is an integer equal to or greater than two;
 - an emissive layer comprising an organic electroluminescent material, positioned on the electron-injecting layer;
 - a hole-injecting layer positioned on the emissive layer, the hole-injecting layer comprising a polymeric compound and a movable anion, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable cationic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two; and
 - a metal electrode deposited on the hole-injecting layer.
16. (Previously presented) An electroluminescent device comprising:
- a transparent substrate;
 - a semitransparent electrode deposited on the transparent substrate;
 - a hole-injecting layer positioned on the semitransparent electrode, the hole-injecting layer comprising a polymeric compound and a movable anion, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable cationic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two;
 - an emissive layer comprising an organic electroluminescent material, positioned on the hole-injecting layer; and,
 - a metal electrode deposited on the emissive layer.
17. (Previously presented) An electroluminescent device comprising:
- a transparent substrate;
 - a semitransparent electrode deposited on the transparent substrate;

Appl. No. : 09/995,816
Filed : November 27, 2001

a electron-injecting layer positioned on the semitransparent electrode, the electron-injecting layer comprising a polymeric compound and a movable cation, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable anionic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two;

an emissive layer comprising an organic electroluminescent material, positioned on the electron-injecting layer; and,

a metal electrode deposited on the electron-injecting layer.

18. (Previously presented) An electroluminescent device comprising:

a transparent substrate;

a semitransparent electrode deposited on the transparent substrate;

an emissive layer comprising an organic electroluminescent material, positioned on the semitransparent electrode;

an electron-injecting layer positioned on the emissive layer, the electron-injecting layer comprising a polymeric compound and a movable cation, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable anionic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two; and

a metal electrode deposited on the electron-injecting layer.

19. (Previously presented) An electroluminescent device comprising:

a transparent substrate;

a semitransparent electrode deposited on the transparent substrate;

an emissive layer comprising an organic electroluminescent material, positioned on the semitransparent electrode;

a hole-injecting layer positioned on the emissive layer, the hole-injecting layer comprising a polymeric compound and a movable anion, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable cationic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two; and

a metal electrode deposited on the hole-injecting layer.

Appl. No. : **09/995,816**
Filed : **November 27, 2001**

20. (Previously presented) The electroluminescent device of Claim 1, wherein in the hole-injecting layer, the movable ion is an anion.

21. (Previously presented) The electroluminescent device of Claim 1, wherein in the electron-injecting layer, the movable ion is a cation.

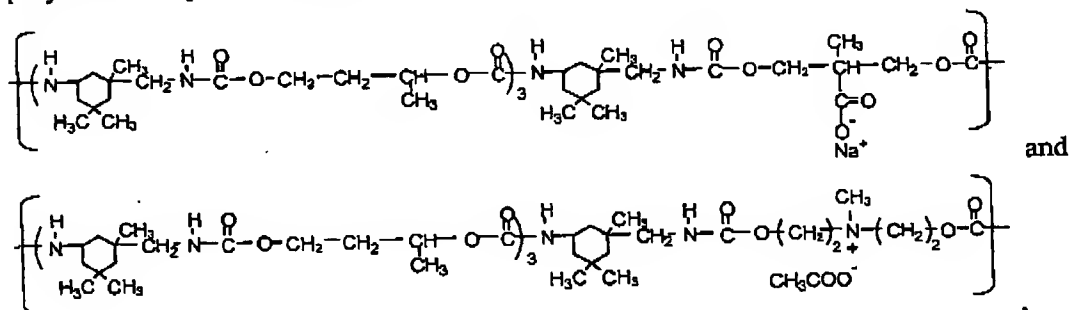
22. (Previously presented) The electroluminescent device of Claim 1, wherein the at least one block is selected from the group consisting of poly(ethylene oxide) and poly(propylene oxide).

oxide).

23. (Previously presented) The electroluminescent device of Claim 1, wherein the at least one of the hole-injecting layer and the electron-injecting layer has conductivity of greater than 1×10^{-8} s/cm.

24. (Previously presented) The electroluminescent device of Claim 2, wherein the at least one of the hole-injecting layer and the electron-injecting layer has conductivity of greater than 1×10^{-8} s/cm.

25. (Previously presented) The electroluminescent device of Claim 2, wherein the polymeric compound comprises one or more segments selected from the group consisting of:



wherein Na^+ and CH_3COO^- are the movable ions.

Appl. No.
Filed

: 09/995,816
: November 27, 2001

COPY

LISTING OF THE PENDING CLAIMS

1. (Previously presented) An electroluminescent device comprising at least one of a hole-injecting layer and an electron-injecting layer, wherein the at least one of the hole-injecting layer and the electron-injecting layer comprises a polymeric compound and a movable ion, wherein the polymeric compound has at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable ionic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two, and wherein the movable ion and the at least one non-movable ionic moiety are counter ions.

2. (Previously presented) An electroluminescent device comprising:

a substrate;

a first electrode deposited on the substrate;

an emissive layer comprising an organic electroluminescent material;

a second electrode deposited over the electron-injecting layer;

at least one of a hole-injecting layer and an electron injecting layer, the hole-injecting layer being positioned between the emissive layer and the first electrode, the electron-injecting layer being positioned between the emissive layer and the second electrode; and

wherein the hole-injecting layer, the electron-injecting layer, or both, comprises a polymeric compound and a movable ion, wherein the polymeric compound has at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable ionic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two, and wherein the movable ion and the at least one non-movable ionic moiety are counter ions. (Currently amended) The electroluminescent device of Claim 2, wherein the substrate comprises a material selected from the group consisting of glass, quartz, and polyethylene terephthalate.

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3. (Previously presented) The electroluminescent device of Claim 2, wherein the first electrode comprises a material selected from the group consisting of lead oxide, indium tin oxide, doped polyaniline, doped polypyrrole, doped polythiophene, and polyethylene dioxythiophene.

4. (Original) The electroluminescent device of Claim 2, wherein the emissive layer comprises a material selected from the group consisting of emissive conjugated polymer,

COPY

Appl. No. : 09/995,816
 Filed : November 27, 2001

emissive non-conjugated polymer, emissive monomeric or oligomeric material, poly(meta-methylacrylic acid), poly(styrene), and poly(9-vinylcarbazole).

5. (Original) The electroluminescent device of Claim 4, wherein the emissive conjugated polymer is selected from the group consisting of poly(*p*-phenylene vinylene), poly(thiophene), poly(*p*-phenylene), poly(fluorene), poly(arylenes), poly(arylene vinylene), polyquinoline, polypyrrole, polyaniline, polyacetylene, and derivatives thereof.

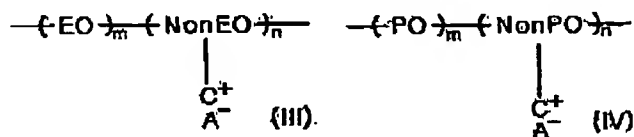
6. (Original) The electroluminescent device of Claim 4, wherein the emissive non-conjugated polymer is a polymer having non-conjugated main chains and side chains substituted with emissive functional groups.

7. (Original) The electroluminescent device of Claim 4, wherein the emissive monomeric or oligomeric material is selected from the group consisting of alumina quinone, rubrene, anthracene, perylene, coumarine 6, Nile red, aromatic diamine, N,N'-diphenyl-N,N'-bis-(3-methylphenyl)-1,1'-biphenyl-4,4'-diamine), (3-(4-biphenyl)-4-phenyl-5-(4-tert-butylphenyl)-1,2,4-triazole), (dicyanomethylene)-2-methyl-6-(*p*-dimethylaminostyryl)-4*H*-pyran, and derivatives thereof.

8. (Previously presented) The electroluminescent device of Claim 2, wherein the second electrode comprises a material selected from the group consisting of aluminum, magnesium, lithium, calcium, copper, silver, iron, platinum, indium, palladium, tungsten, zinc, gold, lead, and alloys thereof.

9. (Previously presented) The electroluminescent device of Claim 2, wherein the movable ion in the hole-injecting layer is an anion.

10. (Previously presented) The electroluminescent device of Claim 2, wherein the polymeric compound is represented by one or more formulas selected from the group consisting of the formula (III) and formula (IV),



wherein EO represents ethylene oxide; NonEO represents non-ethylene oxide; PO represents propylene oxide; NonPO represents non-propylene oxide; A⁻ represents an

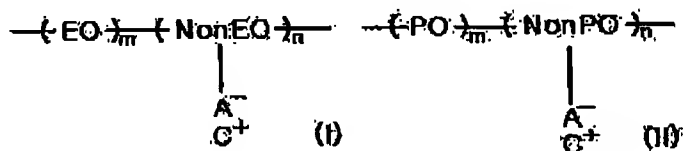
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Appl. No. : 09/995,816
 Filed : November 27, 2001

anion; C^+ represents a cation; $m + n = 1$; and n represents a number more than 0 and less than 1.

11. (Previously presented) The electroluminescent device of Claim 2, wherein the movable ion in the electron-injecting layer is a cation.

12. (Previously presented) The electroluminescent device of Claim 11, wherein the polymeric compound is represented by one or more formulas selected from the group consisting of the formula (I) and the formula (II),



wherein EO represents ethylene oxide; NonEO represents non-ethylene oxide; PO represents propylene oxide; NonPO represents non-propylene oxide; A^- represents an anion; C^+ represents a cation; $m + n = 1$; and n is a number more than 0 less than 1.

13. (Previously presented) An electroluminescent device comprising:

a transparent substrate;

a semitransparent electrode deposited on the transparent substrate;

a hole-injecting layer positioned on the semitransparent electrode, the hole-injecting layer comprising a polymeric compound and a movable anion, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable cationic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two;

an emissive layer comprising an organic electroluminescent material, positioned on the hole-injecting layer;

an electron-injecting layer positioned on the emissive layer, the electron-injecting layer comprising a polymeric compound and a movable cation, the polymeric compound having at least one block of $[O-(CH_2)_x]_{y'}$ units and at least one non-movable anionic moiety, wherein x' is an integer equal to or greater than two, wherein y' is an integer equal to or greater than two; and

a metal electrode deposited on the electron-injecting layer.

Appl. No. : 09/995,816
Filed : November 27, 2001

COPY

14. (Previously presented) An electroluminescent device comprising:
a transparent substrate;
a semitransparent electrode deposited on the transparent substrate;
an electron-injecting layer comprising positioned on the semitransparent electrode, the electron-injecting layer comprising a polymeric compound and a movable cation, the polymeric compound having at least one block of $[O-(CH_2)_{x'}]_{y'}$ units and at least one non-movable anionic moiety, wherein x' is an integer equal to or greater than two, wherein y' is an integer equal to or greater than two;
an emissive layer comprising an organic electroluminescent material, positioned on the electron-injecting layer;
a hole-injecting layer positioned on the emissive layer, the hole-injecting layer comprising a polymeric compound and a movable anion, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable cationic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two; and
a metal electrode deposited on the hole-injecting layer.
15. (Previously presented) An electroluminescent device comprising:
a transparent substrate;
a semitransparent electrode deposited on the transparent substrate;
a hole-injecting layer positioned on the semitransparent electrode, the hole-injecting layer comprising a polymeric compound and a movable anion, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable cationic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two;
an emissive layer comprising an organic electroluminescent material, positioned on the hole-injecting layer; and
a metal electrode deposited on the emissive layer.
16. (Previously presented) An electroluminescent device comprising:
a transparent substrate;
a semitransparent electrode deposited on the transparent substrate;

Appl. No.
Filed

: 09/995,816
: November 27, 2001

COPY

a electron-injecting layer positioned on the semitransparent electrode, the electron-injecting layer comprising a polymeric compound and a movable cation, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable anionic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two;

an emissive layer comprising an organic electroluminescent material, positioned on the electron-injecting layer; and,

a metal electrode deposited on the electron-injecting layer.

17. (Previously presented) An electroluminescent device comprising:

a transparent substrate;

a semitransparent electrode deposited on the transparent substrate;

an emissive layer comprising an organic electroluminescent material, positioned on the semitransparent electrode;

an electron-injecting layer positioned on the emissive layer, the electron-injecting layer comprising a polymeric compound and a movable cation, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable anionic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two; and

a metal electrode deposited on the electron-injecting layer.

18. (Previously presented) An electroluminescent device comprising:

a transparent substrate;

a semitransparent electrode deposited on the transparent substrate;

an emissive layer comprising an organic electroluminescent material, positioned on the semitransparent electrode;

a hole-injecting layer positioned on the emissive layer, the hole-injecting layer comprising a polymeric compound and a movable anion, the polymeric compound having at least one block of $[O-(CH_2)_x]_y$ units and at least one non-movable cationic moiety, wherein x is an integer equal to or greater than two, wherein y is an integer equal to or greater than two; and

a metal electrode deposited on the hole-injecting layer.

COPY

Appl. No. : 09/995,816
 Filed : November 27, 2001

19. (Previously presented) The electroluminescent device of Claim 1, wherein in the hole-injecting layer, the movable ion is an anion.

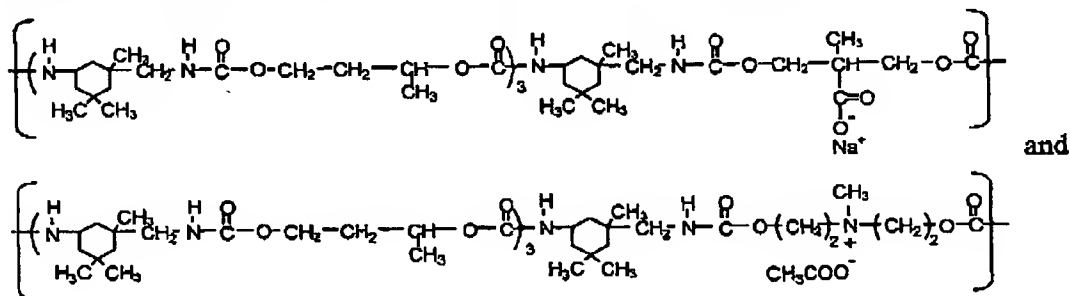
20. (Previously presented) The electroluminescent device of Claim 1, wherein in the electron-injecting layer, the movable ion is a cation.

21. (Previously presented) The electroluminescent device of Claim 1, wherein the at least one block is selected from the group consisting of poly(ethylene oxide) and poly(propylene oxide).

22. (Previously presented) The electroluminescent device of Claim 1, wherein the at least one of the hole-injecting layer and the electron-injecting layer has conductivity of greater than 1×10^{-8} s/cm.

23. (Previously presented) The electroluminescent device of Claim 2, wherein the at least one of the hole-injecting layer and the electron-injecting layer has conductivity of greater than 1×10^{-8} s/cm.

24. (Previously presented) The electroluminescent device of Claim 2, wherein the polymeric compound comprises one or more segments selected from the group consisting of:



wherein Na^+ and CH_3COO^- are the movable ions.

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